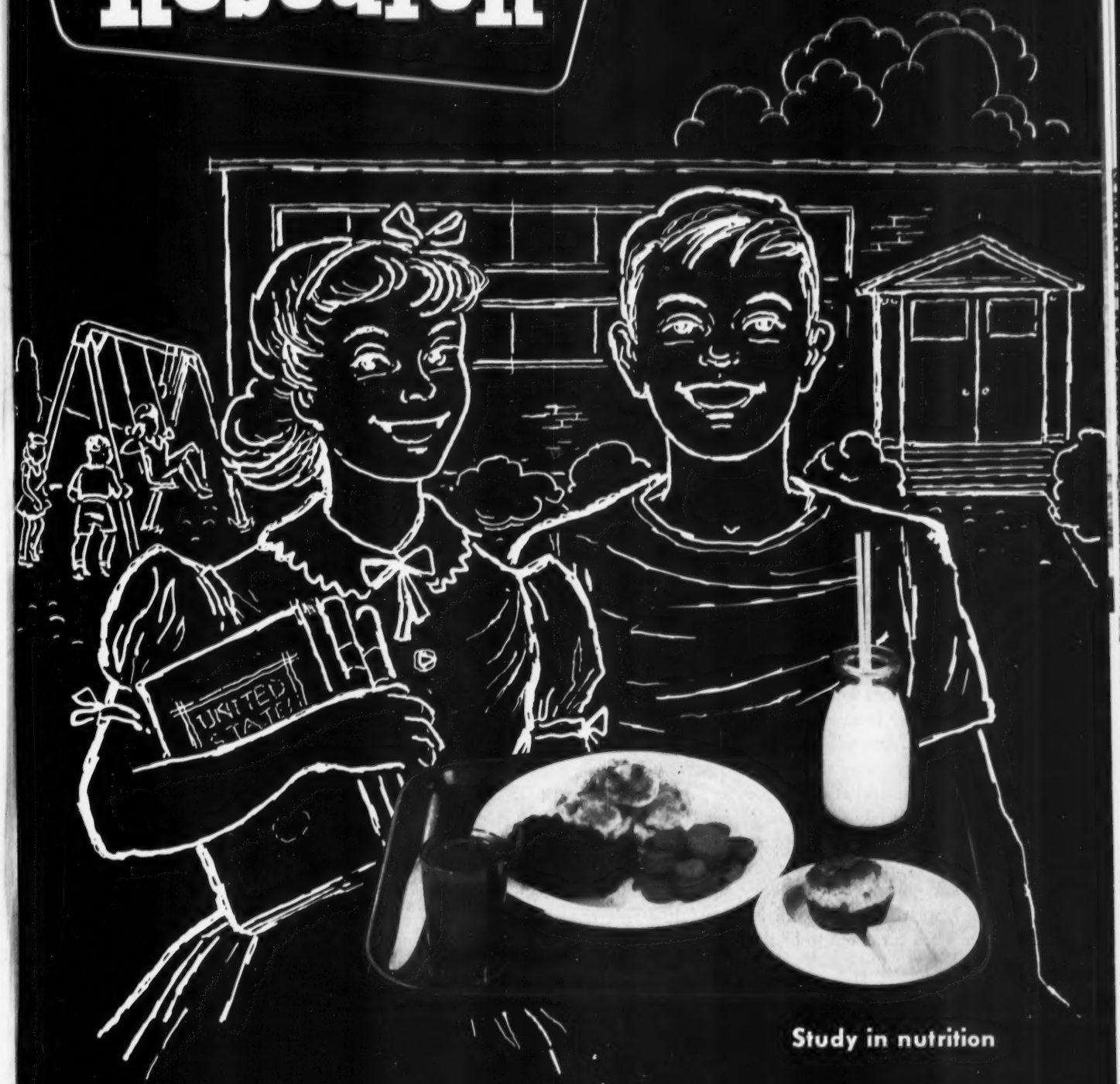
AGRICULTURAL Research

SEPTEMBER 1954



Study in nutrition

AGRICULTURAL
Research

VOL. 3—SEPTEMBER 1954—NO. 3

JOSEPH F. SILBAUGH—MANAGING EDITOR

YOU CAN HELP

It's September. Time for school again. And that reminds us how much we need one of the finest products of our schools—and one of our Nation's most important resources—well trained scientists.

We don't have enough of them today to do the research that needs to be done. In fact, as a result of the GI-enrollment drop, inductions for Korean duty, and fewer students coming up from the low-birth-rate 1930's, we're even worse off than we were right after World War II.

The lack of physicists is alarming. The demand for chemists and engineers is greater than the supply. There's little or no margin of safety in the agricultural sciences; some specialists—plant and animal pathologists, for example—are critically short at the present time.

And signs indicate that we're going to call for *still more* men and women with the keen, curious, creative minds to look into the world about us, as well as to apply and develop what they find there:

1. Such efforts are gaining support. In agriculture, advances like resistant crops, improved livestock, better chemicals have *sold* research.

2. Our population is growing. It now looks like at least 200 million by 1975. Feeding them will take more production—a fact that Congress recognized in providing increased research appropriations this year.

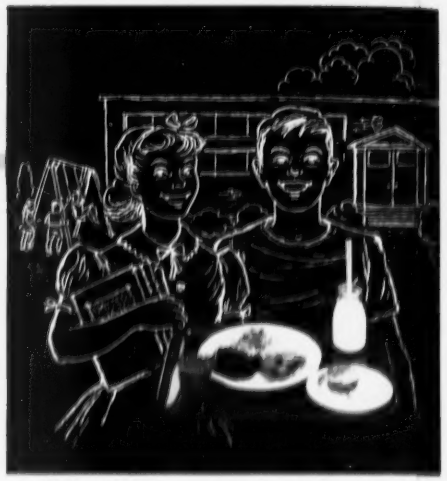
3. We probably won't continue to be satisfied to slide along spending only 1 research dollar out of 5 on *fundamental* studies. In the past, we've relied heavily on Europe for basic discoveries and concentrated here on applying them. We can't slack off on application, of course, but many people feel we would be wise to build up our own *foundation* work.

So we're likely to need even more scientists in the future. But there are certain important points that we must keep in mind:

Training researchers takes time—8 years or so from high school. It takes equipment and staffs for our colleges and universities. It takes support for our graduate students, in-service training for our scientists.

And it takes something else that many of our AGRICULTURAL RESEARCH readers can supply *now*, as the new school year gets under way: encouragement and guidance to apt young people to go into graduate work and prepare for satisfying careers in research. This encouragement and guidance often turns out to be the most important influence of all.

AGRICULTURAL RESEARCH SERVICE
United States Department of Agriculture



SCHOOL LUNCH, constantly being improved through research, is now served to 10 million fortunate youngsters every day through the National School Lunch Program (see pages 8, 9).

Contents

Making Insecticides Last Longer 15

● CROPS AND SOILS
Wind Erosion . . . Problem in Mechanics 3
Secrets of the Rice Kernel 6
How Much Fertilizer? 7
Verticillium Wilt of Cotton May Yield 7

● FOOD AND HOME
Our Goal: 10 Million Good Lunches 8
Check Up on Subfloor Timbers 9

● LIVESTOCK
Researchers Look for Meat-Type Hogs 10
New Plum Island Lab Works on Viruses 10
The Cost of Parasites 11

● POULTRY
New Goals for NPIP and NTIP 12

● FRUITS AND VEGETABLES
Now It's Tomato Powder 13
New Peach Variety Good Under Irrigation 13

● DAIRY
M. E. Can Tell Her Fortune 14
Treating High-Moisture Silage Helps 14

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ERODING SOIL PARTICLES *trace flight patterns in the wind. Light on the horizon shows the surface creep of coarse sand particles. Medium particles, at first rolled and then bounced into an arched glide called saltation, leap or jump along the ground. On striking the ground they dislodge fine dust particles, which, due to their minute size and sheltered position in the soil surface grain, have escaped the force of wind. Fine dust particles, thus bounced into the air, lie in suspension (upper) and float long distances.*

Wind erosion

. . . PROBLEM IN MECHANICS

DUST STORMS—recurrent every spring on the Great Plains and *ruinous* after drought once every dozen years—may at last yield to science.

Stubble farming (AGR. RES., June 1954) is capable of protecting the land most years. But in those occasional blighted years (1954, for example) when there's no effective vegetal cover, dead or alive, proper emergency tillage will help save even bare soil of most types.

This is the conclusion of soil conservationist A. W. Zingg and his associates from a study of soil-particle

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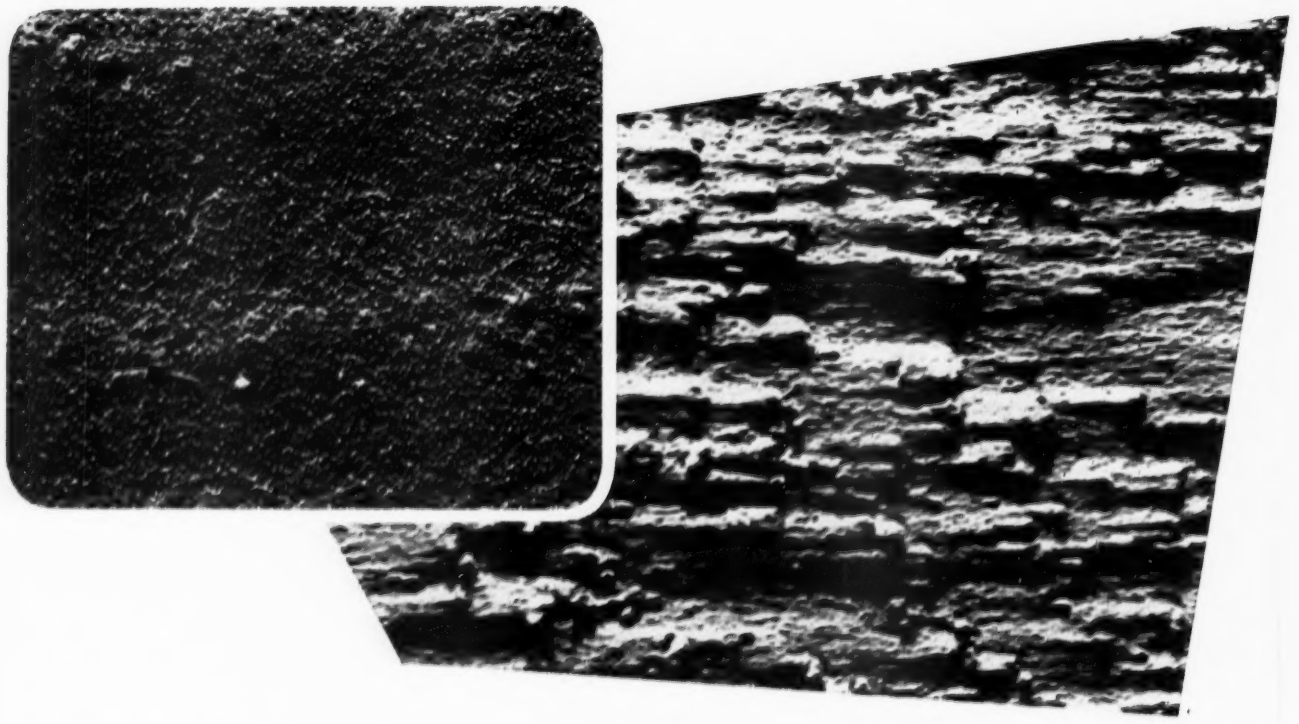


NO MATCH FOR THE WIND, the silt-loam topsoil (left)—92 percent highly-erodible particle sizes and 8 percent nonerodible clods—blew seriously. An 18-m. p. h. blow in wind-tunnel tests removed enough soil in 30 minutes so that projecting clods (right) sheltered the remaining blowable particles and stopped the erosion. However, high winds or the breakdown of clods from heat, drought, freezing, thawing, surface-tillage, or other forces would make the soil erodible again. A cloddy bed's the goal when there's no cover.

structure and behavior at the USDA-ARS experimental wind tunnel, Manhattan, Kans.

Wind-breaks (where adapted), deep plowing to bring up clay subsoil, strip cropping, and other measures are being studied and developed. Width, spacing, and type of vegetation can be planned from wind-tunnel data.

Scientists consider most present measures inadequate for disastrous droughts, such as occurred in the mid-30's. But such a drought isn't expected again for three-quarters of a century—time enough for more research.

Preventing soil particles from getting into motion and halting their destructive sweep across fields are keys to controlling erosion. Our knowledge of these phenomena came from wind-tunnel studies. High-speed photographs of moving soil, and analysis of particle-size make-up of blown soil, showed how it happens.

The *finest* silt and clay dust particles nestle in the surface grain of the soil and avoid the wind. But gusty wind as light as 8 m. p. h. will move *medium* particles—cause them to roll along the ground and, on collision with other elastic particles, to bound into the air, spinning 200 to 1,000 r. p. m. By this dramatic leaping and jumping action called saltation, they can traverse a field—usually moving a fifth or a fourth as far up as forward. The stronger the push of the wind, the higher the bounce and the longer the glide.

When a saltating grain strikes fine, wind-proof particles, it projects them into the air where, suspended, they float long distances. When it strikes large nonblowable particles or when the wind dislodges coarse particles, they roll in a sort of surface creep.

In wind-tunnel studies, topsoils of fairly high clay and clay-loam content erode till projecting clods shelter the remaining blow soil against the wind. A cloddy bed such as that, stabilized by man and not by wind, is the goal when cover is not available.

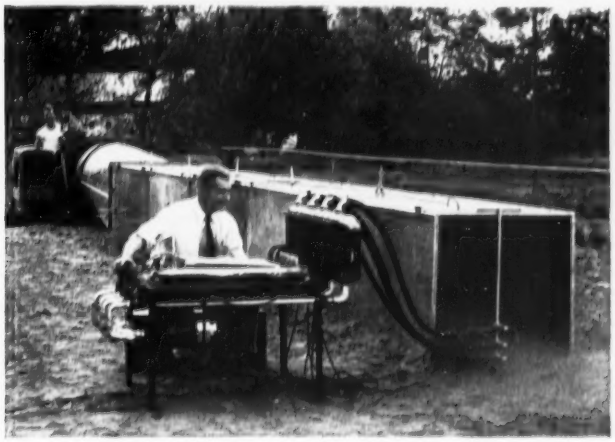
It takes quite a bit of clay or fine silt and sometimes moisture to form clods. On sandy lands of the plains, much of the clay and silt have been lost from the plow layer—must be brought up from the subsoil. The field is strip-plowed with chisels (4 inches wide, 24 inches apart, and 12 to 18 inches deep). Where this has been tried, from 10 to 50 percent of the land was turned at each plowing. Emergency tillage of this type should start ahead of the spring blow period and rotate across the field—a new strip at each sign of erosion.

Some valuable lessons have been learned from field-erosion history, too. As wind moves across erodible land, it needs greatest velocity at the starting edge to move soil. Surface crust and clods there resist erosion. But in absence of obstructions—windbreaks, crop residues, surface roughness—it proceeds across the area, sorting out organic matter, fine silt, and clay and depositing them to leeward. Sand remains behind—coarsens the windward part of the field, lowers its fertility and ability to grow vegetative cover, and leaves it more erodible. To leeward, the leveling, increasingly-erosive deposits become progressively more vulnerable to milder winds.

Erosion can be tamed, therefore (sometimes in the absence of stubble cover) by shortening its downwind range. Furrows plowed crosswind help some, but erosion soon fills them. ARS is studying combinations of grass cover, strips of varying plant types and spacing, and all possible devices to develop a workable system for a dust-free plains agriculture. But permanent sod appears to be the only answer for some shallow sandy lands.

Stubble-mulch cropping, shelter belts, and strip cropping for the normal years, and surface clodding for the eight-per-century extreme dust years, look like a combination deserving thorough trial on the Great Plains.☆

WIND TUNNEL OPERATOR collects a sample of the soil blown from the surface of this field by a wind of controlled force. Test data from this study show particle-size composition of blown soil and how much soil loss to expect before the surface is stabilized.



LISTING LAND CROSSWIND is standard practice on the Great Plains for reducing the drag of the wind and curbing erosion. Here surface creep to leeward has started filling up the furrows. Wind-tunnel test will show how long the ridges will hold the soil.

ALTERNATE STUBBLE-FALLOW and strip crops firmly hold the soil most years but, after successive drought years, both kinds of cover fail. Stripping various plants across field, and in various spacings, is being studied to find out how to immobilize soils.

EMERGENCY DEEP PLOWING to bring up clods was the last resort for this Kansas field. A 3-year drought left the land bare. Half of field (light strips) was chiseled at start of windy season. When clods broke down and erosion began, intervening strips were tilled.

SECRETS OF THE

Rice

KERNEL

TWO ADVANCES can be credited to the most comprehensive study of rice-kernel composition that we've ever made in this country:

1. Prospects for higher yields of white rice to growers and millers.

2. More exact knowledge of this important food's nutritional value.

The USDA–ARS Southern Regional Research Laboratory cooperated with the Arkansas, Louisiana, and Texas experiment stations in making this study. The goal was to learn more definitely whether the *variety* of the grain and the *environment* of the growing plant make noteworthy differences in the product. To compare differences, physically and chemically, chemist C. L. Hoffpauir and his associates obtained from each State experiment station samples of the same 8 commercial varieties of rice grown in 3 crop years.

Scientists first determined the proportional yield of hull, bran, and milled rice from the rough rice. Then they traced the distribution of such nutrients as protein, starch, and minerals through the three parts of the grain. (Some similar work on B vitamins had previously been done at the Arkansas station.)

The researchers found that variety does make a difference—big enough to be considered—in the proportion of milled rice obtained from rough rice. Milled fractions from the eight varieties ranged from 70.2 to 73.5 percent. Highest yield came from Caloro, a Japanese type (see pictures). At current prices, a 3 percent advantage would add about 25 cents profit to 100 pounds—or enough to pay for drying the moist grain after harvesting.

Smaller—but still rated highly significant—were milling-yield differences linked with environment. Why and how the growing grain is affected by its environment isn't well understood. Complex relationships among such conditions as planting time, temperature and humidity, and soil nutrients seem to be involved.

Varieties differed little in starch, the nutrient that makes rice a major energy food. But samples from the different localities varied in starch content to a degree that the scientists rated highly significant.

Of special interest to dietitians is reassurance that rice can be used in diets that must contain the least possible salt. No appreciable trace of sodium was found in either white rice or bran, regardless of variety or where the plant grew.

Because of the value of phosphorus compounds in human and animal nutrition, the scientists gave this mineral particular attention. They determined the amounts of various forms of phosphorus as well as total phosphorus in both bran and white rice. Neither variety nor environment seemed to make any difference in total phosphorus. (White rice is low in this mineral; bran is high.)

Similarly, researchers found no evidence that variety or environment makes any significant difference in the tiny amounts of such minerals as iron, manganese, and boron that occur in all parts of the grain.

Rice breeders are among those expected to put the findings to use. The technical data will aid them in planning research aimed at further improvement of rice varieties.☆

HOW MUCH *Fertilizer?*

Farmers hear a lot about boosting yields with fertilizer, and the steadily rising use of fertilizer shows they've been listening. But most farmers still don't use enough—not as much as would be profitable.

Many *would* use more if they knew the when's and how's, says the North Central Farm Management Research Committee. Its fertilizer-economics subcommittee, representing USDA-ARS and land-grant colleges, recently reported on profitable use of fertilizer in the Midwest. This stresses the need for more fertilizer facts.

When does it pay to use more fertilizer? How much more should you use? How can you get the most out of fertilizer when money's scarce?

Fertilizer is used most profitably, the subcommittee points out, when the gain in yield from an increased application just pays for itself.

Take one experiment with wheat, for example. Using 25 pounds of nitrogen per acre raised the yield 6 bushels per acre. At 50 pounds of nitrogen, yield went up 3 more bushels; at 75 pounds, 2 more bushels; at 100 pounds, 1 more bushel. Which fertilization rate paid best?

Assume 25 pounds of nitrogen costs $3.38 and wheat brings $2.20 per bushel (about current prices).

Each acre treated with 25 pounds of nitrogen would return $13.20 (6 x $2.20) for the $3.38 outlay. At the 50-pound rate, a farmer would gain another $6.60 by adding another $3.38 worth of nitrogen. At 75 pounds, he'd get $4.40 for $3.38. But the extra bushel gained with a 100-pound application would return only $2.20 for $3.38. Thus, the most profitable level's just over 75 pounds.

Experiments conducted in the Corn Belt demonstrate that fertilization does even better when used along with other improved practices:

Using 60 pounds of phosphate, 25 pounds of potash, and 30 pounds of nitrogen per acre on corn, a farmer can boost returns by about $13 per acre over fertilizer cost. If he uses other improved farming practices such as planting of better varieties and control of insects and diseases, he can increase net returns by about $11.50 per acre. But when he uses fertilizer and these other improved practices *together*, his returns jump to better than $30.50. Combination paid $6.

A farmer who doesn't have money to buy large amounts of fertilizer must decide how to use in the most profitable way what he *can* afford:

A Wisconsin experiment showed that a farmer with $900 to spend could gain $1,755 with 4½ tons of lime, 750 pounds of 0–20–20, and 150 pounds of 3–12–12 per acre on 20 acres (a 4-year oats-hay-hay-corn rotation). But if he cuts the 0–20–20 to 300 pounds per acre, his $900 covers 29 acres, gaining $2,169. The return *per acre* is lower ($75 compared to $88), but covering the extra acres boosts *total* net returns.

If one element's needed more than others, heavy use of that element makes the most of limited funds. Or if one crop in a rotation responds better than others to fertilizer, it pays to use plenty on that crop.

The subcommittee suggests that profitable fertilization rates for various crops, fertilizers, soils, localities, and capital might be put up in simple chart form for farmers.

Better information should help more farmers prove for themselves that well-used fertilizer is one of the best investments they can make.☆

Verticillium wilt of COTTON may yield to plant breeders

With fusarium wilt of cotton now largely under control through resistant varieties, USDA–ARS plant breeders are making considerable headway in controlling that other serious cotton wilt, verticilllium.

Acala 442, verticillium-tolerant strain developed at the Shafter (Calif.) field station, has been grown in the West for several years. Careful selection each year has increased foundation-seed tolerance to the point where few of the 1953 plants died under exposure.

Verticillium tolerance has now been obtained experimentally in some southeastern varieties. It has been found in certain selected inbreeds of the fusarium-resistant Empire and Auburn varieties, and the fusarium-tolerant Plains variety. Another—Hartsville—is tolerant to verticillium but not to fusarium wilt.

When the cotton breeders are satisfied they have the maximum tolerance or resistance readily obtainable for verticillium wilt, seed increase will be started—a process requiring at least 5 years to build up an adequate seed supply for farmers.☆

OUR GOAL:

10 million good lunches

GOOD EXAMPLE of a school lunch: macaroni-cheese-egg main dish, carrots, broccoli, tomato juice, muffin with butter, milk. (Type A lunch pattern calls for at least a 2-ounce serving of protein-rich cooked or processed food; ¾ cup of vegetables, fruits; ½ pint of milk; whole-grain or enriched bread; 2 teaspoons of butter or margarine.)

WHEN SCHOOL lunch bells call "Come and get it!" 10 million young Americans now line up for a meal served through the National School Lunch Program.

More schools join the program each year, thereby benefiting more children and making good use of more of our country's abundant foods. And each year, research provides new facts on the nutritional value of the meals being served, as well as new help to improve them.

Closely concerned in these advances are human nutritionists of Agricultural Research Service. They work with another USDA agency, Agricultural Marketing Service, which administers the school lunch program.

Because of research, 1954 is a vitamin-A-and-C year in this program. Lunch managers from Maine to Hawaii are being urged and helped to bolster their menus with more foods that furnish vitamins A and C—hardest of nutrients to get into school meals. Furthermore, vitamin C is easily lost in storing and cooking food.

Backing for a drive like this comes from surveys in the schools. As part of one such survey made in 6 States and the District of Columbia, 70 sample meals were analyzed chemically to supplement first-hand observations of what was served on plates and what was left uneaten. Chemists found that meals lacking citrus—38 of the 70—were low in vitamin C, even though many other foods, properly prepared, could have provided this vitamin.

Children themselves round out the evidence on how well they are fed. ARS and cooperating States have made recent studies of the nutritional condition and diets of population groups, including some of school age.

Analyzing a tiny blood sample from a finger prick, chemists learn of a child's health or poverty in a number of nutrients. For example, blood-serum reports on 766 teenagers in Oregon showed that a third of the girls and half of the boys could benefit from more vitamin C.

Parents have been questioned during surveys about what children eat at home, to gauge how much importance the school meal carries. Answers indicate that a child whose midday meal is poor isn't likely to make up for deficiencies by eating extra-well at dinner or breakfast.

About 8 million children (4 out of 5 covered in this program) now get lunches based on the program's scientifically recommended pattern. This "Type A" lunch

GOOD SOURCES of vitamins A and C are getting extra emphasis this year with school lunch managers from Maine to Hawaii. Studies indicate that vitamins A and C are the nutrients most often short in meals now being served under the National School Lunch Program.

usually proves superior, especially in protein and calcium, when checked against other lunches that children buy. But the scientists have often found that fast-growing teenagers need more calories or more of some vitamin.

Adjusting lunch size to individual children—some bigger and some hungrier than others—is one problem that's now getting attention. The Type A pattern was designed for middle-sized children, 10 to 12 years old, to provide at least a third of their nutritional needs for the day. Some lunch managers adjust the pattern by offering second helpings free or for 5 or 10 cents. But this doesn't work in all cases; hungry children don't always ask for more food, and some of them can't afford the extra money.

Seeking practical help on the matter, AMS joined with 15 States this year to ask what representative schools are doing to fit portion sizes to needs. The reports are now being analyzed for suggestions worth sharing.

Designing a recipe file of unusual completeness is another example of the work that's being done to help lunch managers tailor meals to the needs of children, as well as to make lunches more varied and appealing. This working tool is now being shaped up by ARS scientists.

Recipes developed over the last 7 years in the ARS quantity-cooking laboratory have been reviewed, some improved. The best of these recipes from the standpoint of nutritive value and acceptability will be printed on cards. Along with them is being assembled information on substitutes for major ingredients, as well as suggested foods to serve with the recipe for a well-rounded meal.

Another working tool that lunch managers have long wanted is a handbook of food quantities to buy for 100 servings of a given size. ARS nutritionists are preparing this too. To be based partly on new data now being obtained, this aid will show the edible yields from meats, vegetables, and fruits as procured in today's markets.☆

GOOD LOOK at what youngsters eat and how much they eat gives this nutritionist new survey data that will help scientists plan better school lunches. Fitting the size of the lunch to varying needs of individual children has been one of the most difficult problems.

Check up on SUBFLOOR TIMBERS

Perhaps the house you live in has no basement and you're worried that moisture condensation may cause its subfloor timbers to decay.

You're probably needlessly worried, says Forest Service pathologist J. D. Diller. USDA scientists have been studying crawl-space conditions in houses like yours for the last 12 years in the East.

Subfloor timbers in these basementless houses, largely wartime built, continue generally good.

This doesn't mean that you shouldn't look into the condition of your subfloor timbers. You should. Get into the crawl space and inspect with the aid of a strong flashlight, Diller advises.

Chief cause of decay of subfloor timbers in such houses is continuously high relative humidities (75 percent and over) in the crawl spaces. During late autumn or early winter, just a few hours after the first cold snap, heavy condensation develops on the outer sills, headers, and ends of joists. This condensation will persist for 8 or 9 months, remaining longest on the north, northeast, and northwest sides of the building. It causes a wood-moisture buildup of 20 percent or more and is favorable to development of wood-decay fungi.

In 90 percent of the basementless houses Diller inspected, crawl-space condensation problems resulted from improper grading, absence of gutters and downspouts, and ineffective splash boards.

Correction of these faults where necessary, together with regular opening of foundation vents in early spring, should greatly reduce the trouble.

High relative humidities in crawl spaces can often be decreased to the safety point by providing additional ventilation. Complete control can be obtained, even without ventilation, by covering the soil with a moisture barrier. A soil cover of 55-pound roll roofing has proved effective for long periods. Aluminum foil and laminated papers have also been effective during short periods.

Diller emphasizes that soil cover serves only to control decay caused by moisture condensation. Termites and water-conducting fungi are separate problems and call for special treatments.☆

Researchers are looking for meat-type hogs

Research is stepping up the pace in studies of profitable marketing of the meat-type hog.

Right now, USDA-ARS animal husbandman R. M. Durham is collecting data in a field research program launched this summer by the swine industry to develop methods for identifying superior breeding stock. Part of an over-all swine improvement program, the work is being carried on cooperatively by ARS, State agricultural colleges, swine record associations, and American Meat Institute.

Each breed record association is represented by four purebred herds, selected on the basis of a breeder's willingness to cooperate for 2 years, number of animals in his herd, availability of scales, and location.

The objective is to determine (1) how closely estimates of fatness and conformation of live hogs check with cut-out weights after slaughter; (2) to what extent these characteristics are transmitted to progeny.

Durham first looks over all the hogs in the herd. Next, he and the breeder estimate the fatness of each hog, give it an estimated grade for conformation, and weigh it. Then, using the probe method developed at Iowa State College, they measure the backfat. All of these animals are ear-tagged for future identification.

Durham now takes a sample of five hogs from the herd, tattoos each with a number, and follows them to the packing house. There, he gets *carcass* data to check against the estimates he and the breeder made.

Next year, Durham will return to the same farms to do the same work with *progeny* of the hogs he's working with this year. These breeders will be able to use the data in marketing their breeding stock.

Barrows, gilts, and boars are included since sex influences backfat thickness. Backfat thickness is highly correlated with changes in carcass quality of individual hogs.

A number of States, notably Ohio, Indiana, Michigan, and Pennsylvania, are already active or planning action in closely related programs. Included are studies of grading methods, consumer preference, retail pricing, and other market factors.

Twenty years of research (AGR. RES., Sept. 1953) has shown us how to get the meat-type hog. There are meat-type hogs in every breed.

Housewives' demand for leaner pork, coupled with our mounting fats surplus, is pushing swine raisers to grow and market more of these hogs.

The ARS work and related research throughout the industry is aimed at finding how this can feasibly and profitably be done. It means as great a change in production as in marketing. This will take time.

Durham hopes this field research will help determine the future usefulness of the probe (and other methods in the developmental stage) for identifying top market-type hogs.☆

New lab at PLUM ISLAND goes to work on virus diseases

USDA-ARS scientists started research on vesicular diseases of livestock at the new Plum Island Animal Disease Laboratory in July.

Facilities already on this New York island allowed intensive studies of these diseases—among the most destructive of livestock—to begin almost 2 years ahead of schedule.

Initial work is centered on the virus that causes vesicular stomatitis, similar to foot-and-mouth disease in many ways. Research on foot-and-mouth disease itself may have begun by the time this is in print.

Construction of the main laboratory, also started in July, will take 18 months. In the meantime, a building turned over to USDA by the Army under a use permit has been completely rebuilt for laboratory purposes. Several other buildings will be useful in the research.

Security measures in the present laboratory equal those planned for the main facility and make it one of the most isolated and secure research installations in the world.

The scientists are working toward a number of objectives, including improvement in diagnostic methods, finding out how the viruses are passed from one animal to another, development of more effective vaccines, and such fundamentals as the chemical and physical properties of viruses. Emphasis, of course, is on the dreaded foot-and-mouth disease. M. S. Shahan directs the research.

Completion of the main laboratory will permit four-fold expansion of this program. The laboratory that's now in use limits studies to one phase of a disease at a time.

Plum Island lies 2½ miles off the northeastern tip of Long Island. An Army post for more than 50 years, Plum Island is 3 miles long, 1 mile wide, contains about 800 acres. It lends itself to the rigid safety measures needed for such studies.☆

The cost of

PARASITES

FEW FARMERS have ever seen their livestock free of internal parasites. Often, infested stock is neither quite well nor seriously ill. Since the contrast between well and ill may not be sharp, a farmer's likely to accept less than good growth for good in his animals—and fail to recognize either his loss or the cause of it.

Recently, however, some western sheepmen found their lambs spectacularly unthrifty. These lambs scoured badly and became so emaciated that feeders would buy them only at big discounts, if at all. Many died.

USDA–ARS parasitologists determined that stomach worms and wire worms were causing the scouring.

Could they be controlled with phenothiazine? The researchers launched a 24-week experiment with three groups of parasite-free lambs:

Group 1—on clean pasture. Group 2—on pasture where lambs were exposed to natural infection by stomach and wire worms. Group 3—on the same kind of pasture as Group 2 but allowed free access to a 1:9 mixture of phenothiazine and loose salt.

At the end of the experiment, lambs in Group 1 had gained 21 pounds more than the exposed nonmedicated lambs in Group 2 and 12 pounds more than the exposed but medicated lambs in Group 3. Group 3 lambs gained 9 pounds more than those in Group 2. So the scientists established the cause of the scouring and how to control it. And they reaffirmed that avoiding exposure is the best guard against parasite losses, protection by medication next best.

There are 300 kinds of internal parasites of economic importance to our livestock industry. They caused estimated losses of more than $432 million a year from 1942 to 1951.

In totting up such an approximation, mortality figures are easiest come by. It's more difficult to arrive at loss due to condemnation of parts and carcasses under meat inspection. Even harder is evaluation of the waste of feed, labor, and space expended to raise these animals.

Only a "guesstimate" can be made of the interference with breeding and conception. But internal parasites do cause sterility in some cases. In others, they diminish fertility and vigor, delay conception, cause abortion, reduce litter size, lower egg laying in chickens.

Furthermore, internal parasites account for a vast area of reduced quality, with accompanying lowered market grades and sales value.

Science keeps chipping away at these losses. Phenothiazine, introduced in 1938 by USDA as an effective control of roundworms in sheep, illustrates the progress being made. Here's how this chemical works: We best cut economic losses due to internal parasites by reducing parasite numbers, explains ARS parasitologist Benjamin Schwartz. This is most efficiently done by interrupting their reproductive process.

Phenothiazine does this with sheep. Only about half the phenothiazine they eat is *absorbed* by the animals—the rest goes into the droppings to inhibit the growth of parasite eggs.

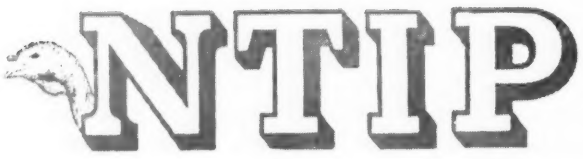
At the Agricultural Research Center, Beltsville, Md., sheep given free access to a 1:9 mixture of phenothiazine and loose salt have stayed essentially parasite-free for 12 years. (The only exceptions developed during an experimental 165-day interruption of the treatment.)

Cattle don't take up enough of the medicated salt to do the job. They do better on a mineral mixture of 3 parts each of salt, bone meal, and crushed limestone and 1 part of phenothiazine (by weight). At Auburn, Ala., ARS scientists tried free-choice use of this mixture in a 2-year trial with 28 calves 4 to 9 months old. It controlled the common stomach worm and cattle nodular worm.

Cattle and swine don't ordinarily show such spectacular symptoms as sheep sometimes do. But the parasites are there, adding daily to farmers' production costs and the nation's food bill. To deal with these pests, science continues to seek other specifics as good as phenothiazine.☆

New goals for

and



THERE'S NO LONGER any provision for pullorum-disease *tolerance* in our National Poultry and Turkey Improvement Plans. Flocks must be *completely free* of pullorum carriers, as indicated by a blood test of each bird.

The decision to eliminate pullorum tolerance came at a biennial conference of the Plans this summer. Poultrymen were saying, in effect, that they have achieved one of the basic objectives of the program embarked on 19 years ago—to reduce losses from pullorum disease.

Commonly spread to the young through the egg, pullorum cuts egg production, reduces hatchability, and kills some adult birds. But it strikes hardest at the *young*, from hatching till they're about 3 weeks old. Mortality losses may range anywhere from 5 to 80 percent during this period, and birds that recover usually become carriers.

Under the Improvement Plans, poultrymen have directed their efforts toward eliminating carriers from breeding stock and meticulously observing prescribed sanitary measures. The Plans also provide for improving production qualities by recognizing superior breeding stock.

The National Poultry Improvement Plan was launched in 1935, the National Turkey Improvement Plan in 1943. These programs are sponsored by USDA–ARS under Congressional authority and administered in 47 cooperating States (all but Nevada) by official State agencies.

From the beginning, breeding-stock recognition has been based on physical appearance, pedigree, or performance of the *individual* bird. The Conference this summer provided that individual birds may now also qualify on the basis of the *family's* showing, as an alternative to individual performance. Entire flocks may now be recognized as "Performance Tested Parent Stock" when their progeny meet the standards in a random-sample test.

Flocks can now also be recognized for *meat* as well as for egg production—which reflects the fact that nowadays we raise more than half of our chicks for meat use.

To qualify for egg production, the entry in a central random-sample test must lay at an average rate of 60 percent. For meat production, the entry must lay at an average rate of at least 50 percent and have an average 9-week weight of at least 2.5 pounds for pullets and 3 pounds for cockerels, or rank in the top third of the entries in rate of lay and weight at 9 weeks.

Recognition of turkey flocks requires that hens in a flock produce an average of 20 poults during an 8-week period and that 90 percent of these live at least 8 weeks.

So chicken and turkey raisers provide another concrete example of how food producers keep step with research. The *turkey* people, abreast of production and marketing research, now market turkeys all year long instead of seasonally. They produce the birds, large or small, that the consumer wants. The *chicken* people, while maintaining their interest in purebred birds, have broadened their program to include participation of cross, incross, and other systems of mating. By providing for recognition of performance in terms of meat production, the chicken people have helped their broiler industry maintain the momentum it has picked up in the last 16 years.

Approximately two-thirds of the Nation's hatchery capacity is now operating under the National Poultry Improvement Plan. About two-thirds of the Nation's turkey breeding flocks participate in the National Turkey Improvement Plan. This would seem to be pretty fair assurance that American consumers are going to have all the chicken, eggs, and turkey they need.

But the members of the two groups aren't resting. They have now included control of the disease fowl typhoid in the Plans on the same basis as pullorum. And there's a third disease called paratyphoid that has its roots in a salmonella organism, just as pullorum and fowl typhoid do. The poultrymen want to see what tools research can provide them for eradicating that one too.

NOW IT'S

Tomato powder

There's a new addition to the growing family of fruit-juice powders developed at the USDA-ARS Western Regional Research Laboratory:

This one's a tomato powder that can be reconstituted into a delicious tomato juice when mixed with water, even ice water. The powder is equally good for use in recipes that call for tomato pastes or purees.

Drying—a method used for ages to preserve food—has never been successfuly applied to fruit juices till ARS scientists developed orange powder (AGR. RES., Mar.–Apr. 1953).

Although they're the ultimate in weight-wise concentration, *powdered* juices are bulkier than high-density juice concentrates. Therefore, to be an advance over concentrates, powders must have some advantage. They do: better keeping properties at high temperatures because of the extremely low water content, no refrigeration needed, lower weight.

The cost of processing juices to powder is higher than that of converting them to the concentrated form, but there are significant savings in transportation and storage.

Tomato powder is prepared by a process—"puff drying"—similar to that for making orange-juice powder. The tomato juice is concentrated and homogenized, then dried in a vacuum chamber. The resulting sponge is pulverized into a fine, flaky powder and canned with a packaged desiccant that removes excess moisture.

Prompting this work was a request from the Quartermaster Corps for a stable tomato powder that could be used either for preparation of juice or as a substitute for tomato paste or puree in menu preparation. Additional uses of the powder may be developed for homes and institutions or remanufactured foods, in both domestic and foreign markets.

The tomato-juice powder is not yet in commercial production. But a plant is under construction in Florida for producing the orange and grapefruit powders. And ARS scientists are making progress on the development of beverage powders from prunes, apples, and pineapples.

Conversion of juices to powders, along with improved marketing of fresh fruits and vegetables and frozen concentrated and canned juices, can go a long way to help stabilize this phase of our agriculture.☆

New variety of PEACH firm and bright under irrigation

Pacific Coast peach growers who've had a hard time getting fruit of firm flesh and high color when produced under irrigation will welcome a new variety named Redglobe.

Developed by USDA-ARS horticulturists in cooperation with State experiment stations in several fruit-growing areas, Redglobe is medium to large with a bright red blush over three-fourths of the yellow skin—a kind of coloring that's popular.

Flesh of the new variety is very firm, fine-textured, of good flavor, and free of the red streaks characteristic of many western varieties. Redglobe stands up well under storage and long-distance shipping.

In experiments in California and Washington, Redglobe compared favorably with other varieties ripening in its season. It also showed promise in Texas and Michigan tests.

Trees of Redglobe should be available for planting by late 1955, and the attractive fruits should appear on the market 3 or 4 years later.☆

M. E. CAN TELL HER FORTUNE

Predicting how much milk a young cow will give at maturity . . . deciding how good her sire is . . . these sound like jobs for a crystal ball.

But USDA–ARS dairy scientists get reliable indications merely by multiplying the milk production of young cows by age *conversion factors*—as simple, say, as 1: 3.

These factors vary slightly with the age of a cow and with different breeds. Anyone can use them. They help dairy scientists conduct the nationwide Dairy Herd Improvement Association sire-proving program.

A young cow's conversion factor applied to her lactation yield gives us her "mature-equivalent" production *potential*, called M. E. If this is greater than the *record* of her *dam* (made under comparable conditions and adjusted to an M. E. basis), it indicates that the sire's influence toward herd improvement makes him a desirable breeding animal. But if the young cow's M. E. is substantially smaller than that of her dam, the sire has a good chance of going to the butcher. (Of course, one case wouldn't decide the matter. It takes records from at least eleven daughters and their dams to "prove" a sire.)

Actual use of conversion factors is easy. Say the value of Sire X is in question. His mate's a mature cow with a record of 11,000 pounds of milk and 440 pounds of butterfat at 6½ years of age. A daughter of this mating, 2½ years old when she started her first record, produced 10,000 pounds of milk and 400 pounds of butterfat in the usual 305-day lactation period. Offhand, this young cow seems to be outclassed.

But the conversion factor changes the picture: she has a mature-equivalent—or future producing ability—of 12,400 pounds of milk and 496 pounds of butterfat. That makes her potentially better than her dam.

Conversion factors were first applied to DHIA work in 1935 on the basis of (1) length of lactation period, (2) number of milkings per day, and (3) age. Within the last year, as a result of careful study of age-production relationships, conversion factors for the different breeds were revised to reflect more accurately differences in production of animals of different ages. Ayrshire, Brown Swiss, Guernsey, Holstein, Jersey, and Shorthorn are included.

The revised factors were based on a study of the 305-day lactation records of nearly 600,000 cows of all ages milked twice a day, reported from 1945 through 1952. The total included figures from a similar study of 211,678 records of the Holstein-Friesian Association.

"This means progress in our efforts to prove sires," says J. F. Kendrick, in charge of DHIA work. "The new conversion factors cut to a minimum the possible margin of error in estimating M. E. production.

"Of course, they aren't permanently fixed and they can become outmoded as conditions change our cattle. We may need further revisions, perhaps to incorporate other production factors, so that our sire-proving analyses will be as realistic as possible."

Conversion tables are available: Dairy Husbandry Research Branch, USDA, Washington 25, D. C.☆

Treating high-moisture SILAGE helps maintain quality

High-moisture forage crops can trouble a farmer who ensiles them without lowering the moisture content. These silages are subject to heavy losses from seepage and fermentation, as well as lowered palatability and bad odors from the bacterial action common in such cases.

Treating this high-moisture forage with a preservative that slows the growth of the undesirable organisms may help meet this problem, say USDA–ARS dairy scientists. Dairy husbandman C. H. Gordon recently tested two chemical preservatives: (1) sodium metabisulfite (see AGR. RES., July 1953, for earlier work) and (2) Kylage. The preservatives were added to the forage as it was blown into concrete stave silos for a 198-day storage period.

Sodium metabisulfite made the best showing, but both of these preservatives improved the quality, odor, and palatability of silage in comparisons with an untreated lot.

Treated silage showed less protein deterioration, more carotene (vitamin A) content, better preservation of dry matter. The problem of high seepage losses, however, wasn't relieved by either preservative.

Gordon noted that the treated silage was less efficiently preserved and less palatable than similar silage given no treatment except wilting.

(The chemical mixture sodium metabisulfite is marketed by two commercial companies. Kylage, a compound consisting mainly of calcium formate and sodium nitrite, is as yet available to only a limited extent.)☆

Making insecticides last longer

USDA-ARS scientists Irwin Hornstein and W. N. Sullivan have found ways of stretching the pest-killing power of some insecticidal sprays.

DDT foliage sprays killed flies for more than 60 days when methyl ethyl ketone (a volatile chemical similar to acetone) was used as a solvent for the insecticide. A normal DDT-oil solution applied to foliage is effective for only about 14 days.

Adding a non-volatile chlorinated terphenyl (a resin-like material) to aldrin and lindane foliage sprays increased their effective life from 10 days up to more than 100 days.

Chemist Hornstein and entomologist Sullivan found out why DDT doesn't form long-lasting residues on foliage when applied as an *oil*-base spray: what happens is that the oil, carrying DDT, penetrates into the leaf. But a highly volatile solvent such as methyl ethyl ketone quickly vaporizes and the DDT stays where it belongs—on the foliage surface.

In the case of aldrin and lindane, using methyl ethyl ketone in place of oil only partly answered the problem of making the sprays long-lived. Unlike DDT, these two chemicals are themselves relatively volatile. Addition of a chlorinated terphenyl to the spray solutions lowered their vapor pressure and, in turn, the evaporation rate of the insecticides.

In concentrated spray solutions of insecticide and chlorinated terphenyl—containing about 50 percent of methyl ethyl ketone by weight—the solvent began to evaporate almost as soon as the spray left the nozzle of the sprayer or mist blower. As the solvent evaporated, the spray droplets became small insecticidal pellets (it would take 300 to 500 in a line to measure an inch) that carried for relatively long distances.

The pellets adhered strongly to the foliage, forming a uniform deposit over the leaves and branches but not penetrating or otherwise causing any damage. The residues didn't readily weather or wash away.

Sprays were applied to pine and spruce trees in the tests. At intervals, twigs were cut from the sprayed trees and taken into the laboratory for tests with flies. During the test period—begun in the fall—daily temperatures varied from as high as 80° F. to as low as 23°. More than 8.5 inches of rain and snow fell.

This work is still in the developmental stage at the Agricultural Research Center, Beltsville, Md., and formulations of the type described aren't yet available commercially.☆

Readers' REACTIONS

MANY DIFFERENT KINDS of people get *Agricultural Research*—teachers, officials, argricultural workers, researchers, committeemen, farm leaders, editors, and so on. But all of you have a common interest in research.

We've heard from many of you: asking for information, raising questions, discussing certain articles, making suggestions.

Your letters are welcome. They help us produce a research magazine that helps you.

Hide-and-seek:

Hyperkeratosis ["Solving for X," June 1954 issue of AGRICULTURAL RESEARCH] has caused a multi-million dollar devaluation of calf skins and cattle hides. I know your reporting has helped, and the placards, too, but it still causes damage.

The leather industry should like to give more publicity to the cause.

I would also like to see reports of work USDA has done on all diseases which affect the hide or skin. I have in mind grub, mange, scabies, etc. I think such diseases cause tremendous losses in skin, hide, and leather, and I should like for the leather and tanning industry to know the work your people are doing.—FRED O'FLAHERTY, Director, Department of Basic Science in Tanning Research, University of Cincinnati.

● Sent USDA Leaflet 355, "Hyperkeratosis (X-Disease) of Cattle," and other information. For a report on the fight against cattle grubs, see our August issue.—ED.

Once over:

We are planning to reprint "Lymphomatosis, Poultry's Worst Disease" [June issue].

Would you have glossy prints of pictures such as were used to illustrate your article?—MORTON ROSENBLUM, Associate Editor, *The Eggsaminer*, Portland, Oreg.

● Yes. We can usually supply prints of our photographs, and other art too.—ED.

Handy tool:

The information in your magazine is very educational, and I read and preserve it carefully. I also find it valuable in radio and farm meetings.—ROSCOE F. DOBBELL, County Agent, Huntington, W. Va.

● Thanks. We'd like to find out how *other* readers use this publication.—ED.

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AGRISEARCH Notes

HOPE: low-tannin lespedeza

Sheep have shown a decided preference for several low-tannin lines of sericea lespedeza developed by USDA-ARS plant breeders. Allowed free choice, the sheep ate 4 pounds of the new sericeas for every pound of the old high-tannin species consumed—this despite the fact that the old sericea is higher in protein and lower in crude fiber. Tannin apparently made the difference.

This legume is considered one of the best, if not the best, for soil improvement and erosion control in the South. It is well adapted to the extremely wide range of soil types found there. It is productive even during drought, and makes a nutritious forage.

Federal and State plant breeders, especially in the South, have been working for several years to improve sericea as a soil-building and conserving crop. Now, USDA-ARS plant breeders P. R. Henson and C. H. Hanson have hopes of combining the new low-tannin characteristics with the other desirable plant features of the species. That would give the South the high-grade, all-purpose legume needed for its growing livestock economy.☆

RISK: increased liability

Liability insurance is more important to farmers than ever before, USDA-ARS agricultural economist J. D. Rush concludes from a recent study.

Increased use of machinery, frequent business trips by cars and trucks, and farm employees' awareness of laws authorizing awards for work injuries have imposed extra responsibilities on farmers with regard to the safety of others. A farmer now has added risks of becoming involved because of injury or death to another person.

He is faced with three types of liability—*personal liability* (maintenance of buildings, livestock control, and the like), *liability to employees* (injury or death suffered by a workman), and *motor vehicle liability* (car or truck involved in personal injury).

Legal and financial responsibilities vary with the State. Detailed information in a particular State may be obtained from insurance agents, lawyers, bankers, or farm-organization representatives. Information on liability under workmen's compensation laws may be obtained from the State industrial commission or board.

A complete report of the study, "Legal Liability Risks and Insurance Protection for Farmers," AIB 122, is available from the Office of Information, USDA.☆

HERE: a resistant alfalfa

Lahontan, a new variety of alfalfa, is practically immune to the stem nematode and resistant to the bacterial wilt disease. For growers in the Antelope Valley of California and Nevada's irrigated valleys, Lahontan fills a long-felt need for a persistent-growing, dependable-producing alfalfa variety.

Lahontan is the result of a 15-year intensive-search for disease-resistant stocks of alfalfa started at Reno, Nev., by USDA-ARS plant breeder O. F. Smith, in cooperation with the Nevada and California experiment stations.

Its breeders expect Lahontan to replace the varieties Nemastan in Nevada and California Common in parts of California. Although slightly less coldhardy than the Northern States alfalfa variety Ranger, it is being test-grown in certain areas of Utah and Oregon where the stem nematode is a problem. Lahontan equals Ranger in bacterial wilt resistance.

Alfalfa breeders are now beginning work to develop a similar variety for areas of the East where the stem nematode has been discovered. Lahontan won't serve because of its susceptibility to other diseases, which are not as serious in the West as in the humid East.☆

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